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A K20 Center Research Brief

Impact of Scientific Calculators on Mathematics Achievement in Low-Achieving Students

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Introduction

The authors highlight long-standing concerns about students' struggles with mathematics, particularly in problem-solving, conceptual understanding, and applying mathematical ideas to unfamiliar contexts. Prior research cited in the article shows that low-achieving students often rely on memorizing steps rather than understanding mathematical relationships, leading to persistent errors and low confidence. Such studies indicate that these challenges are especially pronounced among students who already perform below grade level.

At the same time, decades of international research suggest that scientific calculators, when used intentionally, can reduce computational burden, support conceptual understanding, and increase student engagement. The authors note that Malaysian policy has permitted calculator use since 2003, yet recent research on its impact in Malaysian classrooms is limited.

This study addresses that gap by examining whether integrating scientific calculators into mathematics instruction can improve achievement for low-achieving Form Two students (approximately age 14). The research focuses on two content areas—solid geometry and statistics—where students often struggle with visualization, computation, and multi-step reasoning.

Methodology

Research Design:

The study used an action research design with an embedded quasi-experimental pre-test/post-test structure. Two groups were compared:

- A treatment group that learned mathematics using scientific calculators.
- A control group that learned the same content using conventional instruction without calculators.

The design allowed the teacher-researcher to test a new instructional approach while collecting systematic evidence of its impact.

Sample:
The study included 49 Form Two students (approximately age 14) from a secondary school in Kajang, Selangor, Malaysia.
Participants were:

- Identified as low-achieving based on prior mathematics scores below 50%.
- Taught by the same teacher in intensive mathematics classes.
- Randomly assigned to groups:
    - Treatment group: 25 students (11 boys, 14 girls).
    - Control group: 24 students (12 boys, 12 girls).

Intervention Descriptions:
The intervention consisted of integrated mathematics instruction using scientific calculators during lessons.

According to the article, the intervention included:

- Providing explanations and instructions on how to use a scientific calculator during mathematics lessons.
- Students using the calculator as a learning aid while solving problems.
- Embedding calculator use into the teaching and learning process for the targeted topics.

Dosage:
The article reports that:

- The intervention occurred across six learning sessions.
- A post-test was administered after each session ended.

Communication with the authors confirmed that each session was a minimum of 30 minutes, resulting in a total of at least 3 hours of instruction using scientific calculators.

Data Analysis:
The researchers analyzed pre-test and post-test mathematics achievement scores using:

- Descriptive statistics (means, standard deviations).
- ANCOVA, with pre-test scores as a covariate, to compare post-test outcomes between groups.

This approach allowed the researchers to determine whether the intervention group outperformed the control group after accounting for initial differences.

Results

The findings show a large and statistically significant improvement in mathematics achievement for students who used scientific calculators.

Key results include:

- Treatment group post-test mean: 29.40.
- Control group post-test mean: 11.88.
- ANCOVA showed a significant group effect ($F = 76.607$, $p < .05$).

Practical implications for educators:

- Scientific calculators helped low-achieving students reduce computational errors and devote more time to understanding concepts.
- Calculator use supported engagement and confidence, particularly in topics requiring visualization and multi-step reasoning.

The intervention narrowed performance gaps between low-achieving students and typical expectations for the grade level.

Application into Practice

Schools can use this intervention to support low-achieving mathematics students by integrating scientific calculators into instruction for conceptually demanding topics.

Action Steps for Implementation

1. Provide explicit instruction on how to use scientific calculators during mathematics lessons.
2. Integrate calculator use into problem-solving activities.
3. Ensure all students have access to a scientific calculator during instruction and practice.
4. Use calculators to reduce computational load, allowing students to focus on conceptual understanding.
5. Monitor student use to ensure calculators support, rather than replace, mathematical reasoning.
6. Offer teacher-led demonstrations of calculator functions relevant to the lesson.
7. Align calculator-based tasks with existing curriculum and assessment expectations.

Work Cited

Radzuan, F. S., Kamarudin, N., Khambari, M. N. M., & Arsad, N. M. (2021). Impact of scientific calculators in mathematics among low-achieving students in a secondary school in Kajang, Selangor. *Pertanika Journal of Social Sciences & Humanities, 29*(S1), 199–214.